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ABSTRACT

The 21st Century Learning Initiative is a transnational program concerned with improving education by changing outdated assumptions about how humans learn. This paper summarizes issues behind the organization's work. The first is the biological nature of learning; discussion of this issue includes a description of new research on the very young child's brain, the adolescent's brain and development, and brain plasticity. The second issue concerns the science of learning, with the assertion that metacognition--the ability to think about your own thinking--is crucial in today's information-driven society. The student whose metacognitive skills have been well developed ceases to be totally dependent on the teacher as an external force and progressively becomes part of the learning process. The third issue involves how people construct knowledge, calling for a move away from a dissected, compartmentalized view of reality and learning toward learning systems that embrace the complex, emergent nature of human and natural experience. The fourth issue is the impact of new technology, which is disrupting hierarchies of top-down, controlled learning environments and encouraging the growth of non-institutional, ever-shifting networks of self-organizing learners. The final issue involves restoring the once vibrant role of home and community in the education of young people. The paper concludes that understanding these issues could lead to creation of a new model of learning based on the biological concept of weaning: giving young children all the help they need when they are very young, and then reducing this progressively as they master more skills, so that as adolescence ends, the young person has already taken full responsibility for managing and directing his or her own learning. (EV)

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A 21st Century Learning Initiative Presentation

The work of The 21st Century Learning Initiative is becoming ever better known following the production of the Synthesis document in early January 1997. Members of the Initiative are frequently invited to explain these ideas, and describe how they relate to their own experiences. While work is proceeding on the next edition of the Synthesis, on the building of an interactive web site, and on a variety of strategies for dissemination, the Director, John Abbott, is frequently asked to speak to many audiences in different countries. Recently these have included presentations in Canada, a number of states in America, in London and various other English cities and in Portugal.

Many people have asked for a copy of one of these speeches. While each speech is directed at the interest of the specific audience, that given to a committee of The Council of Scientific Society Presidents in Washington DC in early May contains material common to all the presentations. This is reprinted here. The CSSP comprises the Presidents of the 140 or so Scientific Societies of America.

This speech was illustrated by anecdotes, and not the slides John normally uses for the lecture. As such it makes for easier reflected reading. The speech should also serve to introduce newcomers to these ideas in a relatively direct fashion. Many of the ideas within this speech will be expanded further in a book Abbott intends to published later in 1997 that will set out the way that these ideas have grown and developed, and how they tie into the personal experience of himself, and members of The Initiative.

"Upside Down and Inside Out;" Why Good Schools Alone will never be good enough to meet the challenges of the 21st Century

Please do not be deceived by my English accent! The 21st Century Learning Initiative is truly a transnational program. It comprises some 60 people from upwards of a dozen countries. Each is concerned that so many of the problems encountered within schools and colleges and generally within society at large, owe their origins to outdated, and incorrect, assumptions about how humans learn. If we understood learning better, these people believe, we would not still have the Upside-down, Inside-out system of schooling that we have inherited from the past. It is these outdated assumptions about learning that create many of the problems you have described in your discussions during the last couple of hours.

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The Human Race is, quite simply, the planet's preeminent learning species. That's a stunning thought. It is our brains that give us our superiority over other primates, not our muscles. So why do we have a problem? Let me try and explain.

The human brain is the most complex organism known in the Universe. Not just your brain - by definition you obviously know how to use your brains well - but also the brains of the most infuriating teenagers you ever did meet during last period of a Friday afternoon in mid-winter! The experience of the human race over millions of years, specifically within the last five million years, and even more during the last 100,000 years, is transmitted to each new generation as a series of innate predispositions. Predispositions that enable each generation to "make sense" of its own, unique, environment in ways that enable it to maximize its life chances.

We have big brains - the biggest of any mammal in proportion to our body size. So big and complex are our brains that it is impossible for them to grow to maturity "in utero." Unless, that is, mothers were to carry the developing baby for 27 months! It is difficult enough, I am told, even now to deliver a baby with a big head at nine months...any later and it would become totally impossible. Unlike, say a whale, whose brain is 98 percent formed at birth, the human brain is just less than 40 percent formed. Quite simply our brains have grown so rapidly that the rest of our bodies - specifically the woman's birth canal - have not kept up with the change. So the majority of brain growth takes place outside the womb, most of it in the first three years of life. Human babies are more dependent on the support of their mothers (and mothers on the support of the fathers), and for longer periods of time, than any other species. We must never, ever, forget this.

Once too large to be carried by its mother, the young child in the hunter-gather societies that probably characterized at least 95 percent of our species existence over the past couple of million years, was dependent on getting along with other children. The child who could not socialize, be collaborative, nor was able to solve problems, got left behind when the tribe moved. It simply died. So our species, to survive, has developed preeminent skills of language and sociability.

As children grow both Nurture and Nature, we now realize, are immensely important. The human race is empowered by the inherited experience of its ancestors, but it is also constrained as well. Forced to live in ways that are utterly uncongenial to our nature simply drives people mad.

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Earlier this morning as you talked about education I noted down your list of problems. It went something like this:

* Classroom discipline has broken down; children are out of control.
* We have to find better ways of motivating children, they're just not interested.
* We need better teachers with more qualifications.
* We need a more detailed curriculum…

  …no we don't, we need a broader curriculum.
* We must stretch the gifted child more…

  …no, we must stimulate the average child more.
* We need smaller classes, and more equipment.
* The parents are irresponsible.
* …And so on and so on.

"We need more money," you said, yet you showed little confidence that you thought this would be forthcoming. The reverse seems more likely. You, in the United States, are not alone in fearing that you will have to get better results with fewer resources. All of us have to think in new ways about this. Classically, we just have to think smarter.

That is why the members of The Initiative, comprising researchers, theoreticians, practitioners, and - what I can only call "thoughtful people" - from disciplines as diverse as neurology and anthropology, cognitive science, systems thinking, and the "new sciences" have come together to try and synthesize the conclusions of many different studies of human learning. It is a truly fascinating time to be around. With these new insights we are starting to see that what currently we define as being "problems" could actually be opportunities. Yet, only when we are able to see these from a totally different perspective. Critically this new perspective has to be one of learning, not schooling.

Listening to the conversation just now I found it difficult to recognize what country I was in! The so-called "Crisis in Schools" is certainly not limited to any particular country much as your conversation might have suggested this! The conversation could have easily taken place in London, Toronto, Sydney or New York. It is about something much bigger than simply what happens to children during the 20 percent of their

waking hours spent in the classroom between the ages of five and 18. It is about how humans develop, and how they create particular kinds of environments around them.

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Although this is truly an international story, I had better give you something of my own background so that you will better appreciate the points I will make.

I started my teaching career teaching the top half of the top one percent of the ability range in what was then England's most exclusive secondary school. I know a lot about stretching the able, and too much about over-specialization!

Then, within seven years of leaving University, I became the Principal of a large English High School. My school had been reformed in 1558, and my study was the original temporary classroom put up 420 years earlier. I know, too, about traditions!

I am not a technologist, but I became fascinated in the mid-1970's by the potential of computers, and in particular of word processors. They seemed to offer a splendid way for future generations to escape the drudgery of writing and re-writing essays out in time-consuming long-hand. Eventually I established what was to become Britain's first ever fully computerized classroom, with a terminal for every child. To the amazement of everyone I defined this as being for the use of all subjects other than Computer Studies. That was in 1978.

Exploiting the opportunity which this offered the students were quick to realize how all this challenged conventional ways of doing things. "Can't we stay in here and finish our work in English, even though the bell has rung?" they would say.

"Why can't we do our math in this classroom, rather than being moved to another? Can we take our disks home and work on this later."

And, even more tellingly, some of the students even started to ask teachers to comment on their rough drafts of essays, with the expectation that they would only submit their near perfect piece of work. "Which essay do we mark, Headmaster, the uncorrected one or the revised one?" worried staff would ask.

The new technology immediately challenged existing habits. A set of curriculum practices based on a paper and pencil technology was about to be exposed. No wonder people were worried.

I went to see the Chairman of one of the largest University Examinations Boards in the country, and enthused about the potential of word processing to raise the standards of literacy.

After several minutes he said rather solemnly "are you telling me that the ability to produce second or third drafts is more significant than the ability to write the first draft?"

"Yes." I replied.

"In that case, you must realize that my organization has made a very good living for more than 100 years by examining people's first drafts. I doubt if we will change. In any case we are not sure that drafting and redrafting isn't some form of cheating...we are interested in the pure essence of what is in a student's mind - pure essence, not something that has been changed and modified."

I tried another tack and then went to see the Minister of Education in London.

The Minister listened carefully, he was a thoughtful man, but cautious. "The financial implications of providing everyone with this technology would be quite enormous. The teachers would all need re-training. They would have to start doing things in a very different way. I just don't think this is possible. The Unions say they want more money for teachers, for equipment and smaller classes. There will never be the amount of money needed to cover all this."

I kept silent for awhile before responding. "Maybe if we understood learning better we would see that the contribution technology could make would enable us to re-shape the whole system, so that the whole thing worked better."

"That sounds too revolutionary for me," he responded. "We politicians are in the business of getting re-elected in four or five years time. Our time horizons are short - you would need at least ten years to change all the things you are talking about. You will need a crusade. This is too radical simply for a political decision."

So, that is why I do what I do...try to get people to re-conceptualize the whole learning process. One more story to strengthen the argument.

My eldest son has been using a computer at home since he was eight. Three years ago, at the age of 15, and coming up to his public examinations, his very caring teacher took him to one side and suggested that he should stop using the word processor and practice writing out his answers right the first time. "That," said the teacher "is how you will be marked in the exam."

Later that evening a very annoyed, and very articulate son said, "Dad, doesn't anyone understand? It's not that I write much faster with a keyboard than I ever can freehand, but I just don't think in a straight line anymore. I'm always moving my ideas around as the argument develops."

He looked at me very seriously. "Don't worry, Dad. I'll still do OK, but the exam won't show the best I can do. It's really stupid. Now I know why you do the job you do, but it must be so depressing to see just how slowly things change!"

Indeed, we are still living with a curriculum designed for a paper and pencil technology. If you change the technology then the curriculum and much else must change. If it doesn't then frustration will only increase. This is what a paradigm shift is all about.

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These stories will have already told you much of what I have in mind. Let me now structure this in a way that you will find easy to remember. There are five issues that have to be considered.

The first issue is that of the biological nature of learning. There are three sub-components to this. The first concerns the brain of the young child - the first three years of life. You are already starting to hear a lot

about this. *Newsweek* came out with a fascinating special supplement on all this at the end of April. You will hear much more in the near future. With some 25,000 members of the American Neurological Association, and with the new technologies of PET Scans and functional MRI we can expect to hear of very many more discoveries in the near future. Listen, also, to the work of evolutionary psychologists and evolutionary biologists. They have much to say about putting the work of neurologists into an appropriate context, and helping us see just why our brains are as they are, and what they might shortly become.

Many of you will be aware of recent work on language development. You will know that virtually every child is born with the capability of recognizing about 100 sounds - quite enough to combine in various forms to create all the alphabets in each of the earth's extant 6000 languages. The neurological structures that make this possible are identical to all races. A child born this afternoon in DC and taken this evening to a Swahili speaking home in South Africa would speak perfect Swahili by the age of four or five. Reverse the process and a child from a Swahili homeland could expect to speak perfect English(!) in Washington by the age of five.

To release this potential all that a child needs is plenty of opportunity to hear people talking, and to be encouraged to join in. "Every child needs a continuous commentary on everyday life," said one teacher in Leeds, England, a while ago.

Those sounds not needed in any specific generation - and they will be different sounds according to the land the child grew up in - would be neurologically pruned, by the age of four or five. The brain is essentially economic. What is not needed in one generation is replaced by another more appropriate function. A native speaking Japanese will not have used the equivalent of an L, R or T in his or her own language. Attempting to learn to speak English at the age of 15 or 20 will present a Japanese person with an almost impossible task of correctly articulating these sounds. The ability has just disappeared. There is one exception however, that of neural plasticity, which I will discuss later.

Remember your own experience of speaking foreign languages? Think, now, of children in multi-ethnic deprived urban areas in this country who, by the age of four or five, speak easily three and sometimes four languages. Think of your painful experience when you came to learn a foreign language at the age of 13 or 14. It was frequently sheer hard work. We had missed the opportunity to do this naturally, and at an early stage.

A further illustration of a latent predisposition (this is still 1A for the note takers!). You remember what I said earlier about young people's natural predisposition to play in social, collaborative problem-solving ways? Without such skills individual children found survival difficult in earlier times. Evidence is accumulating to show that the predisposition towards such activities is at its strongest below the age of six. If such skills are not valued, and practiced, in a specific generation then that predisposition towards such behavior is rapidly pruned. Remember, nature is economic. If collaborative skills are not valued then the networks are better replaced with "other" skills that could be useful, such as the behavior of the isolate and the dependent, or a simple regression towards violence.

There is much here to worry us deeply. It is highly likely that there is a direct connection between the child who was not encouraged to develop collaborative skills in the earliest years of kindergarten, and the young graduate who is the despair of his first employer who is staggered to find that "after 16 years of formal education he/she can't think for themselves, can't work in a team, and has to be told what to do." Learning those skills at the age of 23 or 24 is infinitely harder work than learning them naturally at aged five or six.

Rewiring towards aggression is a quite chilling thought. It merits a whole lecture on its own. Follow it up for yourselves in Daniel Goleman's *Emotional Intelligence*, or Joseph Le Doux's *The Emotional Brain*, or Robert Kotulak's *Inside the Brain*. This growing problem is already terrifyingly well documented.

The second subsection (1B) concerns the brain of the adolescent. While most of us can speak from personal experience within our own families of the stresses and strains created by puberty, we know far less about the neurological changes at this stage of life than we do about the brain in infancy. (If I look tired I should tell you that my wife and I and our three sons were deeply involved at 1:30 this morning with one of those convoluted and indecisive arguments of adolescence that nearly always end in a curious mixture of tears and laughter.) Powerful changes are undoubtedly happening, but remember nature is extraordinarily economic. It does little by accident. There must be a reason for adolescence. Earlier generations saw adolescence as a period of great energy, as well as one of turmoil. They learnt how to use this to the good of the community. Indeed, prior to the Second World War no one had even heard of teenagers in the Western World. Why? They were simply too important to the well-being of their families.

Years ago as a geography teacher I took expeditions of 17-year olds from England to live with the Nomads of Iran as they migrated every summer through the high mountain pastures of the Zagros and Elburz mountains. One evening one of the tribal chieftains, thinking he knew me well enough to ask a difficult question, inquired why it was that these young English boys, "were not with their fathers helping to develop the family's business?" I am not sure that I gave a very good explanation, the culture gap was just too enormous. Later that evening one of the English boys, with tears forming in his eyes said "you know I would just love to help my father. Trouble is I don't really know what he does. Certainly we hardly ever talk together. Deep down I feel I have lost something, it's as if I am incomplete."

We have indeed lost something if we see adolescence as a problem, and if they see this as a time of boredom, isolation and disillusionment. By contrast there is nothing more inspiring that an adolescent with a vision, ideally one that is both mentally and physically demanding. They are unstoppable.

We don't yet know enough about the biological basis of this changed state, but we do know that, in culture after culture, the years leading up to and including puberty were a period of progressive weaning, a breaking away of dependence on outside assistance and a requirement to demonstrate ever higher levels of responsibility.

The third subsection (1C) is about Brain Plasticity. It is another topic I will have to leave you to follow-up in depth later. The basic idea, however, is simple. We make our brains as we use them. Their very shape, and the efficiency of their processing, is a measure of the way we operate. The more we use our brains, the more usable they become. A well used brain even gets heavier. A brain, at even quite advanced ages such as ourselves, can learn to do things which at an earlier age were seen to be quite impossible. A damaged brain will so reorganize its remaining faculties that, in many cases, it is able to perform almost as well as before it was disabled.

The second issue concerns the science of learning. The process of learning is as old as life itself. It has passed from simple organization to a collaborative, social, problem-solving activity much dependent on talk, practical involvement and experimentation. If adults assume that learning and schooling are synonymous, young children certainly don't. To them the world is open to endless investigation, and questioning, any of which they regard as legitimate.

Good as they are our natural predispositions to learn are no longer adequate to the needs of our present world. Ways have to be found of extending them so that we can "go beyond what comes naturally."

"What we need from school is help to understand how we learn so that later we can deal with novel situations when there is no one around to tell us what to do," said a 17-year old.

This has to be the central issue. It is called meta-cognition, the ability to think about your own thinking, and the development of skills that are genuinely transferable and not tied to a single body of knowledge, and can therefore be applied in different settings. It is linked to a form of intelligence that is becoming known as reflective intelligence. In a world of continuous change this has to be the fundamental factor, so fundamental that it all too easily gets taken for granted…every learner has to be a reflective practitioner.

Apprenticeship learning essentially "made thinking visible." It was about the development of expertise, not just specialization. At its finest it created within each community numerous sub-groups that were themselves knowledge sharing communities who supported each other in the construction of new ideas and techniques, and who developed very specific forms of collective expertise that went beyond the scope of a single individual.

This is the imaginative flexible learning which a modern knowledge society demands. Writing about complex systems Kauffman stated in *The Origins of Order*: "if the dynamics of the system are too chaotic no learning occurs because there is not enough stability to conserve information. If the dynamics are too static, no learning occurs because no change occurs in response to new information." Powerful learning, it appears, occurs at the junction of chaos and order…in other words with learning systems that value equally both formal and informal strategies.

For years educationalists have debated the rival claims of so called progressive experiential-learning (assumed to be on the political Left), and discipline content-specific directed study (assumed to be on the political Right). Such polarization for too long has obscured the broad middle course which utilizes key ideas from both. Expertise is difficult to achieve without being a specialist, but it is much more than simply specialization. It requires the knowledge of much content, and the ability to be able to think about this both in the specific and the abstract. It is essentially that deep reflective capability that helps people of all ages break-out of set ways of doing things, unseating old assumptions, and setting out new possibilities.

Children, from a very early age can progressively come to understand that a lesson about learning something, can also be made into a lesson about how to "learn-how-to-learn" and remember something. They can become more and more their own teachers.

"What did you do today?" asked a father of an 8-year old boy.

"Well last thing this afternoon we spent an hour reviewing the targets we had set for ourselves on Monday morning. I think this will help me set new targets next week which I think might be more realistic."

In highly industrial terms the child ceases to be totally dependent on the teacher as an external force and progressively becomes part of the "learning productivity process." The older the child becomes, the more the child as a learner becomes a resource that the community has to come to value. The more expert-like they become in their own learning, the more responsible they need to become for monitoring their own outcomes.

Learning is an immensely complex, messy, non-linear process. A story to make my point.

For several summer holidays when my three sons were young, we swapped our home just outside Cambridge England with friends in Virginia. To our children, America was a land of long summer days, plenty of ice cream, and visits to National Parks and historic sites.

Late one evening back in England we were driving home from a day in Derbyshire with the children. My wife was playing a Garrison Keillor tape - the one describing his fictitious one-room school house in Minnesota. "At one end of the room was a portrait of Abraham Lincoln and at the other one of George Washington, beaming down at us like two long lost friends," Keillor drawled in his best Lake Wobegon style.

"That's wrong," piped up 7-year old Tom. "They weren't alive at the same time, so they couldn't have been friends?"

I asked Tom how he knew that. "Well," he said "when we went to Mount Vernon they said how sad it was that Washington didn't live into the 19th century - and when we went to Gettysburg, Lincoln talked to his army and that was 1860 something wasn't it?." His logic and the connections he had built fascinated me.

Several years later, at a dinner party in Seattle, I recounted that story. "How I wish American elementary schools taught history as well as that!" mused our host, a professor of education.

"No," said Tom. "It's not school that taught me that. I just like everything to do with America!"

Our host asked, "what do you like best at school then?"

"Math," replied Tom "because our teacher always gets us to think about connections and patterns. That's really interesting: I can see how things come together."

Patterns and relationships, emotions, the need to make sense, intrinsic motivation, formal and informal learning, history dates and mathematical formulas - these elements in my son's learning defy any logical structure. That's what makes learning such an exciting thing.

The third issue follows on the essential "messiness" of learning - it is about how we construct knowledge. This must sound a dense and terribly abstract topic. It's not at all. We are constructing frameworks for handling new ideas, and reframing old ideas almost all the time.

For several hundred years, since the time of Newton, we have lived with the view of the Universe as a mechanical system composed of stand-alone building blocks. This has shaped our values, perceptions and practices, and has led to a very particular understanding of reality. This understanding has dominated our culture and shaped almost all aspects of our society. Among its teachings was the faith in the analytical approach which glorified the dividing of things into parts. Subjectivity was just not acceptable.

The analytical approach provided powerful evidence for the acceptance of body and brain as machine; of society as a competitive struggle for existence at all levels; a belief in unlimited material progress through economic and technological growth, often at the expense of the environment; and of the supremacy of the ruthlessly aggressive over the integrative and collaborative.

These beliefs and values have shaped most of our social systems and organizations. They have certainly shaped our education system and fashioned the nature of the curriculum, and the way teaching and learning are organized.

However, with the dawn of computers and other technological tools has come the birth of a science able to explore the world's interwoven nature. The new sciences are showing us that to understand what life is and why it is here we must see it as part of an interconnected system. We are beginning to understand that parts of a system change through their participation in the system. The new sciences offer an image of a planet that is hospitable rather than hostile towards life. They require us to come to terms with uncertainty, ambiguity, and to understand the importance of context and relationship. They focus on emergent, creative and holistic processes, rather than on immutable properties and laws. For too long we have forgotten that all living systems evolve and change. They have the ability to self-organize - continually creating new structures and processes that effectively respond to current needs. We live in a world that naturally and spontaneously seeks to create order out of chaos. Complexity out of simplicity.

There is something about these new understandings emerging from science that we feel we already know. We are rediscovering philosophies that are as old as recorded history, and which are cherished in various forms throughout the world. New insights are merging with older beliefs to form new frameworks around which new social structures can be built. Natural systems, including human learning, now seem to be far more dynamic, vibrant and interconnected, and far more responsive to local and unique phenomena - and less predictable in their outcomes - than we had earlier understood. This appreciation of diversity is all part of the transformation.

All this challenges the basic assumption that has guided formal schooling for more than a century in its search to identify those relatively few people with "natural academic intelligence" worthy of ever more educational opportunities. This system largely ignored the less obvious and more diverse skills to be found widely in the majority of the population, and sought to limit these to those basic functional skills needed in a large scale manufacturing economy. Within such an economy learning and schooling were seen to be synonymous; the ability to think for yourself was not only ignored but actually seen as a distraction. This stands in stark contrast to the needs of a "Knowledge Society" in which it is essential that everyone's skills, however diverse, are developed in ways that create personal confidence in the individual's ability to be sufficiently flexible, and have all their wits about them so as to seek out and exploit change. Such people

need to know how to learn new skills, develop new attitudes without waiting to be told - in a word, they have to be "enterprising."

The fourth issue is the impact of new technology, not simply on the way we live, but on the way we come to understand new ideas, process information and create knowledge.

Just as we are undoubtedly on the brink of new understandings about learning, so too are we beginning to see how radical developments within technology can enhance the way in which young people acquire and assimilate knowledge. Information and communication technologies are already disrupting hierarchies of top-down controlled learning environments, and encouraging the growth of non-institutional, ever-shifting networks of self-organizing learners. The Knowledge Age by its very nature is about an increasing dispersion of knowledge and expertise at all levels of society, and within all organizations.

Some of my earlier stories have shown where I stand. Let me give you a further one.

Thirty two years ago this Fall I started teaching geography. Plate Tectonics, the creation of continents, mountains and valleys, was the hot subject of the time. I was fascinated and for six weeks in my first term I shared my fascination with three separate classes of 17-year olds. I covered many a blackboard with three dimensional diagrams, and my students spent hours copying all this out in their books. I thought I had done well until late that term, the BBC produced a two hour documentary entitled The Restless Earth. I was stunned. Here was everything I had covered in six weeks, and much much more.

The following morning I asked permission to buy a copy. "No way" I was told by the Headmaster. "It is far too expensive."

"But," I argued, "if we bought a copy then in future years I could run my three classes together, cover all the topics far more quickly, and go away able to do something more."

My senior colleague looked at me quizzically. "My word, you are an angry young man! Don't you realize the system just can't cope?"

Five years ago we bought a CD ROM system for our home in England. One evening my middle son called me down to the computer. "Dad" he said "you are interested in mountains I think. Look at these three video clips in the Encarta Encyclopedia. They are all about how mountains are made." He ran the program. A strange prickly sensation ran up my neck in a way similar to what I had felt when I first saw <u>*The Restless Earth*</u> *20 years before. Here was everything I had sweated for, for six weeks, reduced to four and a half minutes of carefully contrived video materials. "If we are all that interested, Dad, I could stop the program every ten seconds and give you 27 printouts. Is that what you wanted?"*

"Was that what I wanted?" Was that what learners in the future would need? How much more, or less, did my students from 32 years before grasp from six weeks of conventional classroom teaching?

These are real issues. We still allocate six weeks to this topic, and often we create activities to fill a space. No wonder young people get bored, and no wonder they deride the validity of the study.

So far I have given you four of my essential five components that have to all be in place if we are to turn the present system of schooling "upside down and inside out."

The fifth issue concerns the community where young people spend 80 percent of their waking hours and about which formal education is strangely ambivalent. In England we talk about "A.O.T.," an awful acronym meaning "adults other than teachers," all those people, parents included, who intentionally or unintentionally impact on the experience of young people. Intentional interactions seem to be continuously declining. "The pressures of modern life make it so much harder to find time for our children," honest people confess, while others fail to accept that the pressures they put on themselves do irreparable damage to their children. The average father of a 14-year old boy now spends, on average, no more than five minutes a day in solo contact with his son. The figure is remarkably similar either side of the Atlantic. In the UK, in 1970, 70 percent of seven-year olds either walked to school or rode a bike. By 1994, the figure had fallen to 17 percent. Those precious moments to talk with your friends, with local shopkeepers, and older people are fast disappearing. "It's not safe any longer," people say, "it is better for children to be picked up by a neighbor and driven by car to school."

Streets that are unsafe for children to play on must be as much a condemnation of educational provision as are classes with burned out teachers. Children need communities every bit a much as communities need children.

"What we want to improve for the quality of our own learning" said a group of 17-year olds several years ago. "is more contact with adults other than teachers and parents. We know what are parents think, we hear it all the time. We are not quite sure about our teachers - they are paid to say what they say. But what do real adults think? After all it's their world we'll shortly graduate into, and so far we know precious little about it."

The community, once the historic home of learning of all kinds, largely lost this function in the past 150 years as more and more schools were established, and teaching became ever more professionalized. But the community and home are changing as well. Both are looking for new roles. New definitions of learning could be the clue to revitalizing the home and restoring a practical role to the parents, especially the father. New technologies are opening the home up as a form of an electronic cottage industry. Children and parents are recognizing the force of learning together.

A final story from Sweden.

In the far north of that country the town of Ornskoldswick serves a major high tech industrial complex. So high-tech that in earlier years children did not even know what their parents did at work. How could children possible make valid decisions about their own future employment, worried the community.

Eventually, it was decided to invest in a most carefully worked through Work Orientation program. At the age of seven every child shadows its father at his place of work, his mother at her place of work, and their best friends parents at their work place. Where there is no parent, or where parental work is not really appropriate, substitutes are available.

So successful has this scheme been that the number of days has been increased to five by the age of 10; 10 days by the age of 13; and 15 days at the age of 16. Such orientation is always one-on-one, and with an ever increasing array of adults. Something in excess of 18 weeks orientation will have taken place by the time of leaving school at 18.

"It is not just that this is good for the young people," said the Minister showing me the program, "Think about what it has done for the adults. On average we clean our shoes 12 times more a year than before; we tend to have a shadow about once a month. Secondly, we have got used to being asked apparently naive questions about our work, for which there is no logical answer. In many instances we have changed our work practices accordingly. But thirdly, and most importantly, there is not an adult left in this community who does not recognize first hand that the education of every young person is just too important to be left solely for the teachers to do by themselves in isolated classrooms."

Parenting is a biological necessity for humans. A necessity, that is, for the child who has no way of accumulating that wealth of intuitive understandings, cultural mores, and emotional maturity, unless he or she is cared for unstintingly over very many years by patient, well-meaning and determined parents, supported by other adults in the extended family which in turn is supported in the greater community. To assume that this kind of learning can ever (could ever have been) replaced by formal institutional instruction is to completely misunderstand what it means to be human.

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So, now you have it. If we truly understand these five issues then a new model of learning that could deliver real expertise - abilities acquired through efforts that carry us beyond what nature has specifically equipped us to do - could be ours now for the asking. It would work on the basis of the biological concept of weaning...giving young children all the possible help they might need when they are very young, and then reducing this progressively as the young master more and more skills so that, as adolescence ends, the young person has already taken full responsibility for managing and directing his/her own learning. The age of 18 should become not the age at which people start to become independent learners, rather it should be the age when they demonstrate that they have already perfected that art, and know how to exercise this responsibly.

Formal schooling, therefore, has to start a dynamic process through which pupils are progressively weaned from their dependence on teachers and institutions, and given the confidence to manage their own learning, collaborating with colleagues as appropriate, and using a range of resources and learning situations.

To achieve this, the formal school system and its current use of resources has to be completely re-appraised, and effectively turned Upside-down and Inside-out. Early years learning matters enormously; so does a generous provision of learning resources. If the youngest children are progressively shown that a lesson about learning something can also be made into a lesson about how to "learn-how-to-learn" and remember something, then the child, as he or she becomes older, starts to become his or her own teacher. In highly industrial terms the child ceases to be totally dependent on the teacher as an external force, and progressively becomes part of the "learning productivity process." The older the child becomes, the more the child as a learner becomes a resource that the community has to come to value.

So let me summarize. Given what we now know I do not believe we have the moral authority to carry on with what we are now doing. We have literally to turn our current practice "Upside-down and Inside-out." We have to explore all possible ways of achieving this, and we have to do this urgently, or we will not be able to look the younger generation in the face. They will hold us accountable for our timidity if we do not use every strategy available to us to apply these new understandings.

A society motivated by a vision of thoughtfulness, developed through a form of learning that genuinely extends natural learning capabilities beyond what comes naturally will be revitalized as it changes and grows. This is the transformation for which the Initiative believes we should now be reaching. This involves finally escaping from the 19th century assumption that learning and schooling are synonymous. Good schools alone will never be good enough.

Quite simply, this is about a better world, a more exciting world, a world in which living, working and learning come together and recreate vibrant, self-sustaining communities world wide.

NOTE: The bibliography on which this is based is contained within the Synthesis document available on the web site.

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